

## Recording Extraction Sites of Inert Materials in the Upper Reaches of Pinios River, Western Thessaly, Central Greece

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### Introduction

On a global scale, the combined forces of urbanization and the rapidly expanding industry have increased the stress in natural environment and resulted morphological changes in landforms. The continuous and rapid progress of urbanization around the world and the consequent need for mineral sources has largely destroyed many formerly natural ecosystems (Tsolaki-Fiaka *et al.*, 2018). Extraction of inert materials from rivers is and will remain of great economic importance for Europe. Nevertheless this economic activity can have both immediate and long-term consequences for channel stability (Wishart *et al.*, 2008).

The scope of the present study is to record and map the location of the extraction sites of inert materials from rivers. It is an attempt to illustrate the landscape changes and especially the depositional environments in hydrographic networks due to extraction activity.

### Study area

The study area is the upper reaches of Pinios River, which is located in Western Thessaly, at the west part of the fertile plain of Thessaly in central Greece. Its course starts at the northwestern part of the Trikala prefecture, from the confluence of Ion and Malakasiotis rivers. It is surrounded by mountainous areas which enclose its drainage basin and form its watershed. The altitudes of its drainage basin vary from 74 to 2,204 m a. s. l. The major tributaries of the upper reaches of Pinios River are: Ion river to the north, Malakasiotis, Klinovitikos, Portaikos, rivers to the west and south and Lithaios river to the east. They drain large, heterogeneous areas, through extensive hydrographic networks (Figure 1).

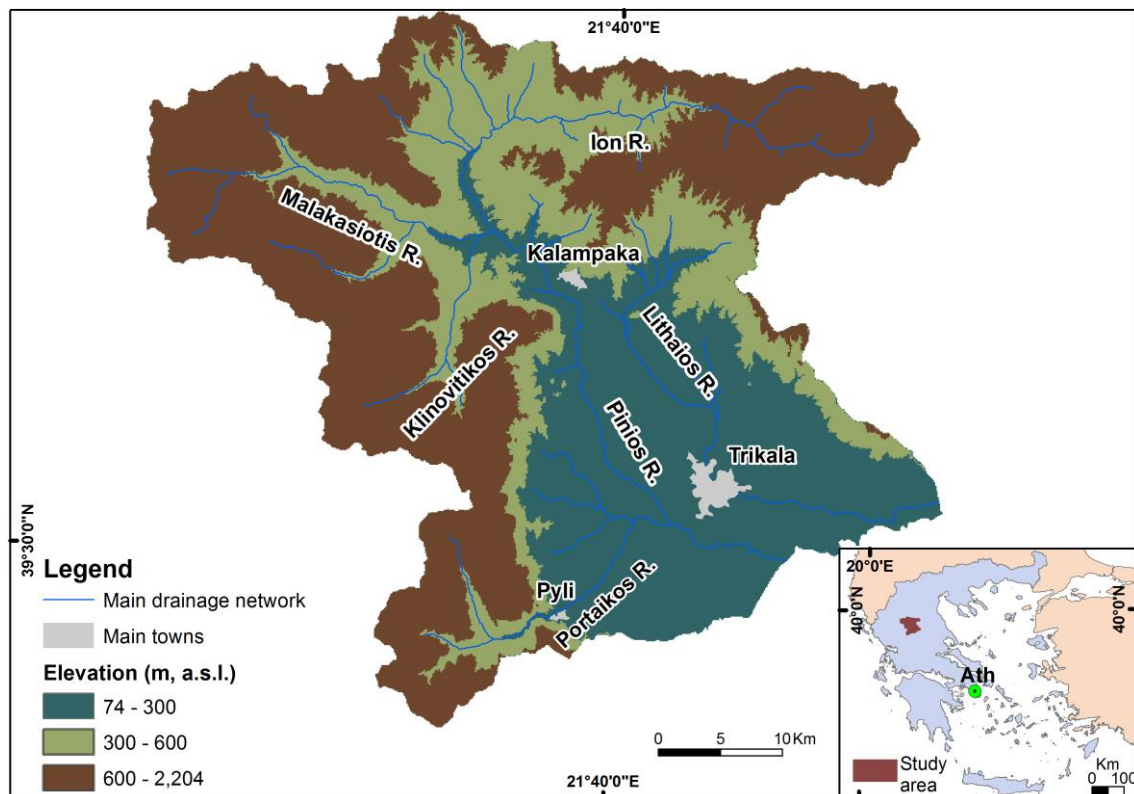


Figure 1. The location map of the study area; the elevations of the study area, the drainage network, and the main towns area (Ath, stands for the city of Athens).

## Data and Methods

As a first step the locations of extraction sites of inert materials were recognized on satellite image. The next step was the verification of the location by field work. Geomorphological mapping was undertaken at a scale of 1: 5,000 in the upper reaches of Pinios River. It involves the determination of elements such as rivers, fluvial deposits and erosion. For the purpose of the present work, some morphometric parameters of the extraction sites of inert materials such as altitudes, area and volume of the removal materials were calculated. The type of removal materials was recognized. Additionally, the impacts of the extraction activity in the river systems were observed.

## Results

A total number of 18 sites of extraction of inert materials in Pinios River and its tributaries were recorded and mapped (Table 1). Moreover, Table 1 shows their altitude, the area of extraction, the volume and the type of removal materials.

**Table 1. The sites of extraction of inert materials in Pinios river and its tributaries, their altitude, the area of extraction, the volume and the type of removal materials.**

ID	River	Altitude (m)	Area (m <sup>2</sup> )	Volume (m <sup>3</sup> )	Extraction material
1	Ion	260	7,730	19,325	Sand
2	Ion	260	1,360	2,720	Sand
3	Ion	260	7,200	10,800	Sand
4	Ion	260	2,200	3,300	Sand
5	Malakasiotis	310	1,030	1,030	Silt-Sand-Pebble
6	Malakasiotis	302	1,500	750	Sand-Pebble
7	Klinovitikos	291	12,500	10,000	Pebble-Sand
8	Klinovitikos	290	5,000	15,000	Pebble
9	Portaikos	198	1,300	2,600	Gravel
10	Portaikos	216	15,000	40,500	Gravel
11	Portaikos	186	5,000	10,000	Gravel
12	Pinios	227	15,300	35,190	Pebble
13	Pinios	219	40,000	68,000	Sand-Pebble
14	Pinios	185	5,900	38,350	Sand-Gravel-Pebble
15	Pinios	185	7,240	8,688	Sand-Gravel
16	Pinios	167	111,200	667,200	Sand-Gravel-Silt
17	Pinios	157	18,000	144,000	Sand-Pebble
18	Pinios	91	470	376	Silt
	Total		257,930	1,077,829	

The total area of the extraction sites reaches up to 257,930 m<sup>2</sup> and the total volume of removal materials are 1,077,829 m<sup>3</sup>. The types of the removal materials are mainly sand and gravel. The extractions from the tributaries of Pinios river include mainly coarse grained materials. The removal materials come either from the riverbed or from the banks of the river and its terraces. In many cases the extractions have caused changes to channel morphology and bank erosion. Today, many of the extraction sites are inactive.

## References

- Tsolaki-Fiaka, S., Bathrellos, G.D., Skilodimou H.D. 2018. Multi-criteria decision analysis for abandoned quarry restoration in Evros Region (NE Greece). *Land*, 7 (2), 43, doi: 10.3390/land7020043.
- Wishart, D., Warburton, J., Bracken, L. 2008. Gravel extraction and planform change in a wandering gravel-bed river: The River Wear, Northern England. *Geomorphology*, 94(1-2), 131-152.